AMENDMENTS TO THE DRAWINGS:

The attached drawing sheet includes one (1) replacement sheet replacing original sheet 1, with amended Figure 1 and Figure 2.

Specifically, the drawings are objected to because Figure 1 does not show that the "hard test barrier layer (116) extends along the sides of said conducting layer pad (114) and said conducting layer pad (114) is completely enclosed by said diffusion barrier layer (112) and said hard test barrier layer (116);" as the claims recite.

The amendment to the drawings, amends Figure 1 to include extensions along both sides of conducting pad layer 114 from the hard test barrier layer 116 down to the diffusion barrier layer 112 in Figure 1, as required by the Examiner. No new matter is added. Entry of the amendment is respectfully requested.

REMARKS

Claims 1 – 5, 7 – 14 and 21 – 25 remain in the application and stand rejected. Claims 5, 12, 14 and 25 are amended herein. Claims 6 and 15 – 20 are previously canceled. No new matter is added.

The "examiner should always look for enabled, allowable subject matter and communicate to applicant what that subject matter is at the earliest point possible in the prosecution of the application." MPEP 2164.04, last paragraph (emphasis original).

The drawings are objected under 37 CFR 1.83(a) to because Figure 1 does not show that the "hard test barrier layer (116) extends along the sides of said conducting layer pad (114) and said conducting layer pad (114) is completely enclosed by said diffusion barrier layer (112) and said hard test barrier layer (116);" as the claims recite. While the applicants are unaware of any requirement that all features be shown in a single drawing, rather than by superposition of multiple drawings, rather than belabor this, an amended Figure 1 is included herewith.

Specifically, Figure 1 is amended to include extensions (not to scale) along both sides of conducting pad layer 114 from the hard test barrier layer 116 down to the diffusion barrier layer 112 in Figure 1, as required by the Examiner. No new matter is added. Entry of the amendment, reconsideration and withdrawal of the objection is respectfully requested.

Claims 5, 14 and 25 are rejected under 35 U.S.C. §112, for failing to support the recitation therein that array pads may be spaced at minimum pitch. Responsive thereto, claims 5, 14 and 25 are amended herein to recite that subsequently formed C4a may be formed at 3 mil bump pitches and finer. This is supported in the Application at paragraph 0018 ("finer C4 pitch, e.g., 3 mil bumps and smaller."). Claim 12 is amended for clarity.

No new matter is added. Reconsideration and withdrawal of the rejection of claims 5, 14 and 25 under 35 U.S.C. §112 is respectfully requested.

Claims 2 – 4 and 8 – 14 are rejected under 35 U.S.C. §112, for being indefinite. Specifically, the Office action asserts that barrier metallurgy is indefinite in claims 2 – 4; and adhesion/barrier is indefinite in claims 8 – 14. Applicants aver that these claims are definite.

"The preferred diffusion barrier pad 112 is a layered pad of tantalum/tantalum nitride (Ta/TaN) or titanium/titanium nitride (Ti/TiN) or a layer pad of materials selected from titanium tungsten (TiW), chromium (Cr) with an adhesion layer of chrome-copper (CrCu), titanium (Ti) or nickel vanadium (NiV) formed on the barrier metallurgy." Paragraph 0014. Thus, a person of ordinary skill in the art would find it clear that the preferred diffusion barrier layered pad may be an adhesion layer formed on barrier metallurgy. Therefore, claims 2 – 4 are definite.

Further, with regard to claims 8 – 14, it is apparent that the recited layer has both properties, i.e., adhesion and that of a barrier. So, claim 9 specifically recites that, like a Twix bar, this adhesion/barrier layer is two layers: an adhesion layer formed on the barrier metallurgy. Thus, a person of ordinary skill in the art would find "adhesion/barrier layer" clear and claims 8 – 14 are definite. Reconsideration and withdrawal of the rejection of claims 2 – 4 and 8 – 14 under 35 U.S.C. §112 is respectfully requested.

Claims 1 – 5, 7 – 14 and 21 – 25 are rejected under 35 U.S.C. §103(a) over U.S. Patent No. 6,232,212 to Dengani et al. in view of U.S. Patent No. 5,631,499 to Hosomi et al. The rejection is respectfully traversed.

The Office action asserts that "Degani discloses (see, for example, FIG. 8) a UBM (**durable chip pad**) comprising an Al contact (terminal metal layer) 13, first layer (diffusion barrier layer) 21, second layer (adhesion layer) 22, copper layer (conducting layer pad) 23, and gold layer (plate passivating layer) 24." Page 4, #7 (emphasis added). However, the Office action acknowledges that "Degani does not disclose a hard test barrier layer." *Id*. If "Degani does not disclose a hard test barrier layer;" then Degani does not disclose a durable chip pad.

Be that as it may, the Office action turns to Hosomi et al., asserting that "Hosomi discloses (see, for example, FIG. 3 1) a semiconductor device comprising a second thin metal film (**hard test barrier layer) 2b** in between two other metal layers. In column 7, lines 31-33, Hosomi discloses the metal film extending onto the passivation film beyond the edge of barrier metal that the edge of the barrier metal is protected from side-etching." Pages 4 – 5, bridging sentence (emphasis added).

"The thin metal **film 2** is used to preserve intensity of **adhesion** between the bump electrode and the passivation film 4. Also, the thin metal **film 2 covers** the entire surface of the **barrier metal 3** to prevent the barrier metal 3 from being etched." Hosomi et al. col. 7, lines 46 – 50 (emphasis added). Moreover, "It can be considered that the same kind of metal as the bump electrode 6 is used as a thin metal film 2. In this embodiment, **an Au thin film** is used as a metal thin film 2." *Id*, lines 52 – 54 (emphasis added). "Furthermore, the different kinds of metal from the barrier metal 3 and the bump electrode 6 can be used as a thin metal film 2. For example, in the case that the barrier metal 3 and the bump electrode 6 are the same as the previous case**, Cu can be used as a thin metal film 2**." *Id*, col. 8, lines 1 – 5 (emphasis added). So, while Hosomi et al. may teach that this single "thin metal film 2 extends onto passivation film 4 sufficiently beyond the edge of barrier metal 3 that the edge of barrier metal 3 has been protected from side-etching;" that is not what the present claims recite. (Certainly with both the thin metal film 2 and the barrier metal 3 terminating on the passivation film 4, the barrier

metal 3 is far from completely enclosed.) Moreover, it is in the single thin film embodiment of gold or copper that extends past the barrier metal 3, not the twin layer embodiment.

Instead, in "the second embodiment [of Figure 3], the thin metal film 2 has the two-layer structure comprising the first thin metal film 2a and the second thin metal film 2b, and the **barrier metal 3** is formed of one layer." *Id*, lines 13 – 16. However, "Pd is used as first thin metal film, Ni is used as second thin metal film, Ti is used as **barrier metal 3**, and Au is used as bump electrode 6." *Id*, lines 17 – 19 (emphasis added). So, Hosomi et al. teaches: 1) a thin metal film 2 (Au or Cu) sandwiched between barrier metal 3 (Ti) and a bump electrode 6 (Au); or, 2) two thin layers Pd and Ni sandwiched between barrier metal 3 (Ti) and a bump electrode 6 (Au), where the Ti thin layer 2b is above Ti barrier metal layer 3. The Ti thin layer 2b, however, does not extend along the sides of the Ti barrier metal layer 3, much less completely enclose it.

Applicants note that the Dengani et al. "first layer (diffusion barrier layer) 21" (*supra*) is a titanium layer and the Dengani et al. "second layer (adhesion layer) 22" (*supra*) is a Cr/Cu layer. Col. 3, lines 41 – 52. So, the Ti layer 21 is 2 layers below the Dengani et al. "copper layer (conducting layer pad) 23," (*supra*). It seems to the applicants that a straight forward combination of Hosomi et al. with Dengani et al., is replacing the Dengani et al. "copper layer (conducting layer pad) 23," with the Hosomi et al. two thin layers Pd and Ni sandwiched between barrier metal 3 (Ti) and a bump electrode 6 (Au).

Therefore, combining the Hosomi et al. two thin layers Pd and Ni sandwiched between barrier metal 3 (Ti) and a bump electrode 6 (Au), with the Dengani et al. structure fails to result in "a hard test barrier layer on, and enclosing, said conducting layer pad," as the claim recite. Moreover, even if the combination were produce such a result, it would still fail to result in the "hard test barrier layer [extending] along the sides

of said conducting layer pad and said conducting layer pad is completely enclosed by said diffusion barrier layer and said hard test barrier layer" as the claims recite. Therefore, the combination of Hosomi et al. with Dengani et al., fails to teach, result in or suggest, the present invention as recited in claims 1, 8 and 21. Reconsideration and withdrawal of the rejection of claims 1, 8 and 21 under 35 U.S.C. §103(a) is respectfully requested.

Moreover, dependent claims include all of the differences with the references, as the claims from which they depend. MPEP §2143.03 ("If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)."). Therefore, Hosomi et al. with Dengani et al. fail to teach, suggest, or result in, the present invention as recited by claims 2 – 5, 7, 9 – 14 and 22 – 25, which depend from claims 1, 8 and 21. Reconsideration and withdrawal of the rejection of claims 2 – 5, 7, 9 – 14 and 22 – 25 under 35 U.S.C. §103(c) is respectfully requested.

The applicants thank the Examiner for efforts, both past and present, in examining the application. Believing the application to be in condition for allowance, both for the amendment to the claims and for the reasons set forth above, the applicants respectfully request that the Examiner reconsider and withdraw the objection to the drawings, reconsider and withdraw the rejection of claims 1 – 5, 7 – 14, and 21 – 25 under 35 U.S.C. §§103(c) and 112 and allow the application to issue.

The applicants note that MPEP §706 "Rejection of Claims," subsection III, "PATENTABLE SUBJECT MATTER DISCLOSED BUT NOT CLAIMED" provides in pertinent part that

> If **the examiner** is satisfied after the search has been completed that patentable subject matter has been disclosed and the record indicates that the applicant intends to claim such subject matter, he or she **may note** in the Office action that **certain aspects or features** of the patentable invention have not been claimed and that if properly claimed such claims **may be given favorable consideration**. (emphasis added.)

The applicants believe that the written description of the present application is quite different than and not suggest by any reference of record. Accordingly, should the Examiner believe anything further may be required, the Examiner is requested to contact the undersigned attorney at the local telephone number listed below for a telephonic or personal interview to discuss any other changes.

Please charge any deficiencies in fees and credit any overpayment of fees to IBM Corporation Deposit Account No. 09-0458 and advise us accordingly.

Respectfully Submitted,

May 20, 2009
(Date)

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APPENDIX